



At the Margins: Livelihood assets and vulnerabilities of Riverside households of the Rio Grande de Mindanao, Southern Philippines

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Abstract

This article describes and explores the livelihood capital assets and vulnerabilities of riverside households of the Rio Grande de Mindanao, Southern Philippines, using the Sustainable Livelihood Framework. We employed an explanatory sequential mixed-methods design, involving a cross-sectional survey of 390 household heads in 16 riverside villages in the first phase, and five Focus Group Discussions in the second phase of the study. We used descriptive statistics to analyze the quantitative data and deductive analysis for the qualitative data. This study demonstrates the limited livelihood capital of the riverside households. These households are generally characterized by weak financial capital, as indicated by their claims on traditional fishing gear as their significant assets, and low, unstable income, which serve as critical constraints on engaging in livelihood diversification strategies. The size and quality of the household's workforce suggest a constrained human capital base. While there is a strong informal network that serves as a safety net, the near-absence of formal networks indicates weak social and institutional capital, which in turn limits access to physical capital and basic infrastructure essential to sustaining and protecting their livelihoods. Furthermore, riverside households face multiple vulnerabilities, including environmental threats such as recurring and prolonged flooding and soil erosion, social unrest, such as the prevalence of rido and armed conflict, and illegal fishing practices. The results contribute to understanding riverside households' limited livelihood capitals and socio-ecological vulnerabilities, which require context-specific policies and interventions to increase their livelihood assets, enhance their adaptive capacities, and achieve sustainable livelihood outcomes, thereby freeing them from the poverty-environment trap.

Keywords: Riverside communities, Livelihood capital, Livelihood vulnerability, Sustainable livelihood framework

Introduction

The Rio Grande de Mindanao, the Philippines' second-largest river and Mindanao's longest, is a vital lifeline for local communities, supplying essential resources (Marlia et al., 2022). As climate change intensifies, flooding and droughts become more frequent (Masson-Delmonte, 2021), exacerbating economic hardships for these communities. These impacts threaten livelihoods, increase vulnerability (Jezeer et al., 2019), and often lead to greater poverty (Onyango et al., 2021; Opiyo et al., 2024). Studies show that households with more assets are likelier to escape poverty and better manage risk (Li et al., 2014; Liu et al., 2018; Zhifei et al., 2018).

This study examines the livelihood assets and vulnerabilities of riverside households along the Rio Grande de Mindanao using the sustainable livelihood framework developed by DFID. This approach considers livelihood vulnerability and context, livelihood capital, institutions, transformation structures, and livelihood strategies leading to outcomes as the components in attaining sustainable livelihoods (Ashley & Carney, 1999; Scoones, 2009). Moreover, Scoones (1999) asserts that the principal component of the framework is the livelihood assets. Understanding the livelihood assets is critical because it serves as the foundation not only for earning an income but also for the households' capacity to manage vulnerability and risks (Li et al., 2014; Liu et al., 2018; Zhifei et al., 2018).

To achieve a comprehensive understanding of the topic, we adopt a pragmatic worldview (Creswell, 2014) as both our philosophical orientation and theoretical lens, with emphasis on social justice. We employed both qualitative and quantitative approaches to address the research questions. This investigation advances the literature on sustainable livelihoods and socio-ecological analysis. Findings could help development agencies and policymakers in South Central Mindanao, Philippines.

Livelihood refers to the household activities essential for sustaining family life (Panthi et al., 2015). Livelihoods are sustainable when they reduce vulnerabilities and build capacity for the future (Pinho et al., 2014). The most cited definition, from Chambers and Conway (DFID, 1992), describes livelihood as "comprising capabilities, assets, and activities required for a means of living." Building on these definitions, a household's livelihood strategies depend on the state of its assets and respond to shocks and risks through portfolios comprising various types of capital (Liu et al., 2018). The relationships among different types of assets within these portfolios—such

as the interaction among financial, human, social, and physical capital—and their accessibility are crucial for achieving a household's livelihood goals (Chen et al., 2018).

The Sustainable Livelihood Framework, introduced by the UK Department for International Development (DFID, 2000), is widely employed to analyze household livelihoods and address rural poverty (Yin et al., 2020). Scholars offer different definitions of the sustainable livelihood approach. For example, Scoones (2009) describes the SLA as how people in different contexts sustain their lives, while Chambers (1995) defines it as "the means of gaining a living." Chambers and Conway (DFID, 1992) argue that a livelihood is sustainable when it can cope with and recover from stresses and shocks, maintain or enhance its capabilities and assets, and avoid degrading natural resources (Scoones, 1998, p. 5).

This framework recognizes the interplay of five livelihood components: vulnerability context, capitals, institutions and structures, strategies, and outcomes (Ashley & Carney, 1999; Scoones, 2009). The vulnerability context encompasses human-induced factors (e.g., armed conflict, social unrest) and natural factors (e.g., climate change) that impact people's livelihoods. Livelihood capitals refer to the resources and capabilities individuals possess, comprising five types of assets: natural, human, financial, physical, and social, which support livelihoods at both household and village levels (DFID, 1999; Hua et al., 2017; Kedir, 2015). Institutions, structures, and processes are the rules and regulations that influence access to these capitals. Livelihood strategies refer to ways people cope with vulnerabilities, including diversification, migration, and entrepreneurship. Livelihood outcomes address improvements in income, education, health, and social networks, which are the ultimate goals of sustainable livelihoods (Scoones, 2009; Morse & McNamara, 2013; Opiyo et al., 2023).

Natural capital encompasses community resources, including water bodies, land, and forests. These provide ecological goods and services, supporting livelihoods (Scoones, 2009). People depend on them for existence and growth (Pandey et al., 2017). Financial capital comprises economic tools and services that enable households to make informed choices about their livelihoods (Morse & McNamara, 2013). Human capital encompasses the knowledge, skills, abilities, and health, enabling individuals or households to pursue livelihood strategies and achieve their goals (Kedir, 2015). Physical capital encompasses core infrastructure, such as water supply, transport, healthcare, and telecommunications, as well as production instruments that support livelihoods (Makheta, 2010). Social capital refers to trust relationships that foster cooperation, reduce transaction costs, and provide informal safety nets for people experiencing poverty (Altasseb, 2021).

Livelihood capital plays a critical role in rural households' lives, as it determines the living standards individuals and households achieve (Yang et al., 2020). Researchers widely use it to study the livelihoods of rural communities, and various international organizations use it to examine the socio-economic status of rural communities in developing countries (Ansoms & McKay, 2010; Abbassi et al., 2020; Huang et al., 2021). This study employed the sustainable livelihood approach to describe the livelihoods of riverside households and explore the reasons why they engaged in these livelihoods, using the sustainable livelihood framework. The SLF, as one of the widely used rural development frameworks (Kunjuraman, 2022), is appropriate for this investigation because of its people-centeredness, which encourages community members, in this case the riverside communities, to be involved in development initiatives (Tao & Wall, 2009). Moreover, this study will focus solely on livelihood vulnerabilities and livelihood capitals, rather than covering all components of the sustainable livelihood framework.

Livelihood vulnerability. Ecologically sensitive areas, such as riverside communities, are often affected by a combination of external shocks and human-induced stresses that are beyond their control. Scoones (1998) noted that those unable to adapt remain vulnerable and unlikely to achieve sustainable livelihoods. Assessing factors contributing to vulnerability is the first step in developing adaptation strategies (Ford & Smith, 2004), including historical adaptive responses to shocks and stresses (Scoones, 1998).

Communities differ in context and climate risk profile (Nurse et al., 2014) and respond uniquely to risks and shocks. Poverty, a key driver of vulnerability, limits the livelihood assets critical for coping with external shocks and economic stress (Pandey et al., 2017), which in turn may cause communities to undervalue the services provided by river ecosystems and increase the risk of overexploitation and environmental degradation (Dubey et al., 2024). For example, riverside fishing communities face income instability due to climate variability (Islam, 2013). Because local conditions shape livelihood vulnerability, adaptation strategies must be tailored to each community and examined through their own perceptions and experiences. This study aims to (1) describe the livelihood vulnerabilities of the riverside households and (2) examine their livelihood capital assets and explore how households utilize their livelihood capital assets to cope with vulnerabilities.

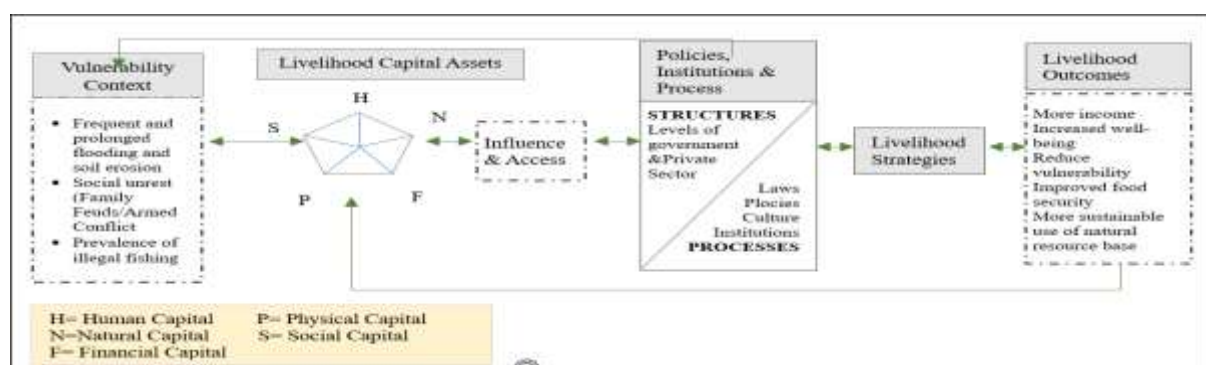


Figure 1: Conceptual Framework adopted from DFID Sustainable Livelihood Framework (DFID, 1999)

Research Methods

The study was carried out in the riverside villages along the Rio Grande de Mindanao River, from the municipality of Datu Piang (upstream) to Kabuntalan, Northern Kabuntalan, Sultan Kudarat (midstream), and finally to Cotabato City (downstream). The total length of the river from Datu Piang to Cotabato City, where the river drains, is 60.34 kilometers.

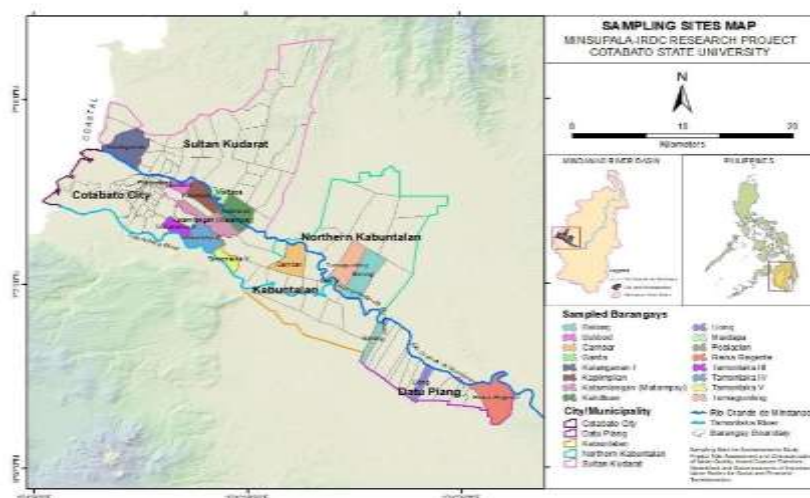


Figure 1: Map of the Sampling Sites

This study employed an explanatory sequential mixed-methods design. We employed a purposive sampling technique to select the villages that would serve as study sites based on specific inclusion criteria: (1) a significant portion of land areas are located alongside rivers; (2) there is no armed conflict occurring during the study period; and (3) residents are willing to participate in the study. A total of 16 villages were included as study sites. We utilized an interview guide to explore and validate the quantitative findings from the survey. We translated the questionnaire into local languages (Maguindanaon and Filipino)

In the quantitative phase, we did a cross-sectional survey of 390 household heads from sixteen villages along the Rio Grande de Mindanao River from August 2024 to February 2025. To capture diverse perspectives from stakeholders, the qualitative phase of the study included five focus group discussions (FGDs) with participants from different categories. Each FGD comprised 15 participants, which included women, farmers, fishermen, youth, and local leaders. The duration of each FGD ranged from 60 to 90 minutes.

The quantitative data gathered through the survey were analyzed using descriptive statistics in a statistical package to obtain frequencies, percentages, and means. Moreover, qualitative data were analyzed using deductive analysis guided by the Sustainable Livelihood Framework.

Results And Discussion

Financial capital

Financial or economic capital denotes the financial resources (economic assets, including basic infrastructure and production equipment, and technologies) essential to pursue any livelihood strategies (Scoones, 1998). These capitals are essential for households to meet their basic needs and cope with and adapt to the impacts of shocks and stresses. The majority (44%) claim that they possess fishing gear and basic farm equipment as their primary production assets, while only a few claim to have farm fields, motorcycles, and livestock. A participant in one of the Focus Group Discussions shared:

“A stable income source is elusive for many of us. Though most people here are engaged in fishing and farming, both are becoming unreliable sources of income. We lend money that serves as our farming capital and pay back once we can harvest. However, in between planting and harvest, we can barely survive. We do not have any savings as our income is just enough for us to survive our daily expenses.” (FGD1 Participant 1)

Riverside households are highly reliant on natural capital, i.e., river resources that underpin their livelihoods. However, these findings indicate that households have limited financial assets, heightening their vulnerability to economic and environmental shocks. Other production sources, including farm lots, habal-habal (extended motorcycle cycles used as public utility vehicles), and livestock, provide significant but less widespread income-generating opportunities, suggesting that households are adopting diverse livelihood strategies. Farm field ownership is an indicator of the mix of livelihood strategies that can serve as food- and income-based coping activities during a low-fish-catch season. Like land, livestock are used by households as a savings and buffer mechanism during emergencies.

Fishing is reported as the most prevalent occupation (52%) and is viewed as the primary source of income for those surveyed. However, participants in the interviews noted that although they regard fishing as their primary occupation, it is no longer a reliable source of income and cannot adequately meet their basic needs. Having inherited this livelihood from their parents, they have observed a significant decline in their fish catch, which

exposes them to financial losses. They further characterized their fish catch as “seasonal,” which compels them to diversify and pursue other livelihood activities independent of using the river’s fish resources.

The households’ overall average monthly income is P9,250.69, which is well below the poverty line set by the National Economic and Development Authority (NEDA), which is the national average of P13,873 per month. These figures reflect persistent economic hardship among residents living along the riverside. The Social Reform and Poverty Alleviation Act defines “poor” individuals and families as those whose income is below the poverty threshold set by NEDA through the Philippine Statistics Authority (Republic Act 8425).

Building livelihood resilience among riverside households required promoting diversification of assets, increasing the accessibility and profitability of productive resources, and developing alternative income-generating activities. Skill development programs, credit accessibility, climate-resilient farming, and sustainable management of fisheries could help increase assets and reduce vulnerability in such communities.

Human Capital

Human capital comprises the knowledge, abilities, health, and competence (DFID, 1999; Baffoe & Matsuda, 2018) that together enable people to pursue different livelihood strategies and achieve their livelihood objectives. This capital represents the quantity and quality of labor resources that enable people to profit from economic opportunities (Oduro et al., 2015; Khuzwayo, 2016, as cited in Opiyo et al., 2023). In this study, the unit of analysis is the household, understood as a collective single team which Levine (2014) described as “acting as an arena of ‘struggle and negotiation’ between people of different generations, sexes, etc.” Our data show that households on the riverbank have limited human capital. The majority (63%) of the surveyed household heads are elementary graduates. Both theoretical and empirical studies consider education as the primary component of human capital. Low levels of education constrain household heads from pursuing higher-return livelihoods, leaving them confined to low-income river-based activities such as fishing, small-scale trading, and casual labor. During the interview, the participants shared that, to cope with limited livelihood opportunities, they engage in fishing strategy innovations that go beyond the community’s fishing regulations. Others admitted that they engaged in driving, labor, and carpentry work in other nearby municipalities. Most participants attributed their limited livelihood skills to low educational attainment and limited access to relevant skills training.

Moreover, the literature identifies workforce size and quality as key indicators of livelihood (Fang et al., 2014). Table 1 shows that although the majority (53%) of respondents were from households with 1-5 members, nearly half of the surveyed households had 6-12 or more members. A significant majority 73% of households, had only 1-2 earning members. A notable proportion (72%) of household members were within non-earning age brackets and classified as dependents, while 28.5% were in the earning group. The above distribution indicates potential economic vulnerability among riverside households. These results align with the Philippine Statistics Authority (2023) data, which show that fisherfolk, farmers, children, and those in rural areas recorded the highest poverty incidence in 2021.

Table 1. Household Workforce Characteristics

Characteristics	Variables	f (n=390)	%
Household Size	1-5 members	208	53.3
	6-8 members	128	32.8
	9-11 members	44	11.2
	12 & above members	10	2.5
Household Composition	5 and below	117	30
	6-12	62	16
	13-19	61	15.7
	20-59	111	28.5
	60 above	39	9.6
Earning Household	None	2	1
Members	1-2 members	286	73
	3-4 members	89	23
	5 & above members	13	3

The riverside households’ quality and quantity of workforce serve as a critical foundation that shapes their livelihood strategies. Adepoju and Obayelu (2013) found that household size, income, and the educational attainment of the household head are dominant factors influencing households’ livelihood strategies. Thus, the ability of households to combine and transform other forms of livelihood capital into sustainable livelihood strategies depends on the quality and quantity of their workforce. Similarly, variations in the number of economically engaged household members and their skill levels, health, or experience have substantial implications for household-level income generation, livelihood diversification, and shock-coping strategies.

Social Capital

Within the sustainable livelihood framework, social capital encompasses the networks that households establish with formal and informal organizations and individuals, which sustain their livelihoods. Humans, as social beings, rely fundamentally on their environment’s social structures and welfare. The majority (82%) of household heads

do not belong to community-based organizations, demonstrating that riverside communities lack formal networks that would facilitate access to vital services and opportunities.

Access to formal institutions is critical in promoting the livelihood adaptive capacity, resilience, and security of the riverside communities. Our data further indicate that many households cannot access services from formal institutions such as government agencies and non-governmental organizations. The orange line [figure 2] indicates that the listed social programs do not cover the overwhelming majority of respondents. Most non-memberships are in the Government Services Insurance System (96%), Pre-need insurance (95.6%), PhilHealth (95%), and lastly, the Social Security System (54%), but still more than half of the population. These findings reflect a critical deficiency in social and institutional capital among the riverside households.

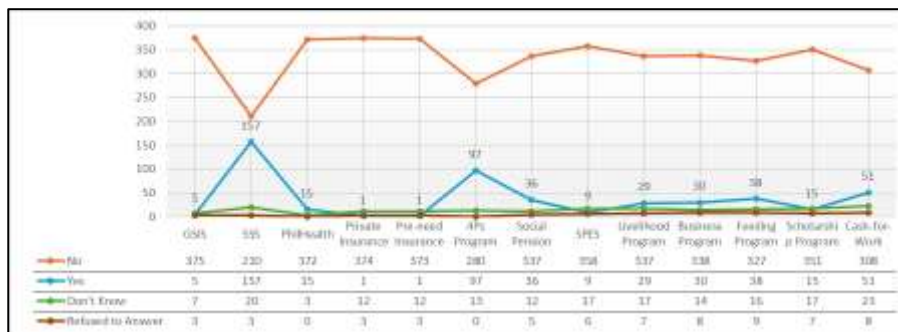


Figure 2: Access to basic social services from formal organizations

A United Nations publication (2021) reported that most rural communities are experiencing difficulty accessing social services. According to the respondents, they are not adequately informed about the existence of these programs. Others claimed during the survey that they do not receive any benefits even after being registered, which discouraged them from joining other programs. Some also added that local authorities tend to selectively inform their relatives when membership registration is available in their barangay.

In addition, accounts from the focus group discussion highlight the limited representation and participation of these communities in decision-making, increasing their vulnerability to exclusion and marginalization. Social capital offers informal safety nets and collective activities (Kuang et al., 2020). These help individuals cope with shocks in a vulnerable environment (Baffoe & Matsuda, 2018). Riverside households have limited access to formal resources, but they maintain a strong informal social security network. Participants highlighted intangible assets, such as the traditional practice of "Kapegkakalimuwa"—collective solidarity—as key strengths. Residents commonly practice Kapegkakalimuwa, especially during times of death and serious illnesses. Neighbors contribute financially to ease the family's burden. During calamities like floods and droughts, mutual support and resource sharing are also common. These findings align with previous studies showing how kinship, cultural, and social assets support riverside households in coping with shocks (Béné et al., 2018) and enhance their likelihood of transitioning to livelihood strategies that are less environmentally reliant (Sargani et al., 2023)

Physical Capital

Physical capital comprises the infrastructures essential to sustain the livelihoods of the riverside communities. Our study shows that at the household level, the majority (85%) own the house, which is mainly built using light materials (76.4%). The prevalence of light materials in houses suggests that households prioritize flexibility and affordability over durability as influenced by persistent flooding, riverbank erosion, and the risk of displacement. In this context, the household's livelihood insecurity is reinforced by physical vulnerability.

Furthermore, although the majority (73%) reported having access to electricity, a significant portion (22%) has no access to a power connection. Access to electricity enables the maximization of human, social, and financial resources. The absence of this restricts income diversification strategies and limits the household's access to information, especially disaster-related and community services. Similarly, a larger share of households (36%) still lack access to proper toilet facilities. When asked during the interview, participants reported that some houses lack toilet facilities because the owners of the lots do not allow the construction of toilets. Several of these houses are built along the riverbanks, where defecation in the river is inevitable, and constructing a toilet is not a priority for these households.

Similarly, households have difficulty accessing drinking and potable water. Sources include hand water pumps (22%), water refilling stations (22%), and connections to major water companies (14%). Meanwhile, 22% with no access to clean water rely on bore wells as an alternative water source. Participants in the focus group expressed difficulty accessing drinking water. They must spend 50–100 pesos per day, which they consider expensive. Some riverside communities in Sultan Kudarat rely on boats to access drinking water, making it even more challenging. Engine boats take approximately 30 minutes to travel from the farthest riverside community in Sultan Kudarat to the nearest village that sells bottled mineral water. The World Health Organization (2020) highlights that access to clean water and sanitation is a pressing issue in many low-income communities along rivers, where infrastructure is often lacking.

Table 2. Households' access to basic facilities

Characteristics	Category	f (n=390)	(%)
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Access to electricity	Yes	304	73
	No	86	22
Access to a toilet facility	Yes	251	64.4
	No	139	35.6
Access to clean and safe water	Yes	304	77.9
	No	86	22
Access to healthcare services	Not Accessible	33	8.46
	Barely Accessible	161	41
	Accessible	101	25.8
	Very Accessible	95	24

Access to healthcare and protecting health enable adults to work and children to learn, making them critical to household livelihood (Ngunjiri, 2018). Many respondents (41%) reported that healthcare is scarce and inaccessible. During a focus group discussion (FGD), a barangay health worker explained, “We do not have a permanent health center here. Whenever the village leader changes, the location of the health center also changes” (FGD3, P3). Another participant added, “Our previous village leader did not actually live here and only visited once a month” (FGD1, P1). While several participants said they turn to self-medication, others rely on traditional healers, who are more accessible. The prevalence of self-medication among the riverside population is mainly due to limited access to health services (Gama & Secoli, 2020). Access to healthcare supports household livelihoods by preventing deeper poverty from illness and joblessness.

Populations with better access to basic social services have more secure and prosperous livelihoods (Conceição, 2022). When examining such access, 40% claim to be members of PhilHealth, 25% are beneficiaries of the Pantawid Pamilyang Pilipino Program, a National Anti-Poverty and social protection program of the Philippine government, and 13% have benefited from cash-for-work initiatives. Despite these numbers, the majority of riverside households still have limited access to basic social services. This finding aligns with the 2022 UNDP report, which highlighted how disparities in access to services, such as healthcare and digital technology, worsened livelihoods during the COVID-19 pandemic (Conceição, 2022).

Participants in the discussion reported being unaware of the existence of these social services. Some respondents indicated that they did not receive any benefits after registering, which discouraged them from participating in other programs. Others noted that local authorities tend to selectively inform specific groups when membership registration is available in their villages. It emerged in the discussion that a lack of awareness, illiteracy, and weak governance of social services appeared to contribute to poor access to social services among households. This supports previous studies highlighting the challenges in accessing social services among rural communities (United Nations, 2021), which are attributed to failures in decentralization, corruption, and insufficient local government capacity (Transparency International, 2021). Limited physical assets influence the livelihood capitals of households because they shape and serve as a foundation for engaging in sustainable livelihood strategies. Thus, enhancing physical capital can improve the livelihood resilience and adaptive capacity of the riverside households.

Natural Capital

Natural resources such as land, water, and ecosystems (Heidari et al., 2019) are considered fundamental assets of riverside households, as they are geographically closer to them (Ahmadpour et al., 2020). Our study shows that at the household level, only 24.6% have lot ownership. Most of these lots are owned by relatives (33.8%), family (24%), government (10.5%), and 10.5% do not know who owns the land where their houses are built. Land ownership is one of the most critical assets the household possesses and an important indicator of vulnerability (Dechassa et al., 2016). The insecure housing tenure reflects limited physical capital among the households.

The Rio Grande de Mindanao not only supports the livelihoods of the riverside communities but also provides ecological goods and services to the households. A total of 83% of surveyed individuals depend on the river for economic activities, including fishing (80%), irrigation (4%), tourism (3%), and transportation (13%). Focus group discussions revealed that during periods of flooding and erosion, community members collect driftwood for fuel or as a source of supplementary income. Residents also obtain firewood from mangroves, forests, and the river. As one participant stated, “Our livelihood depends on this place; we have no plans to leave” (FGD1, P5).

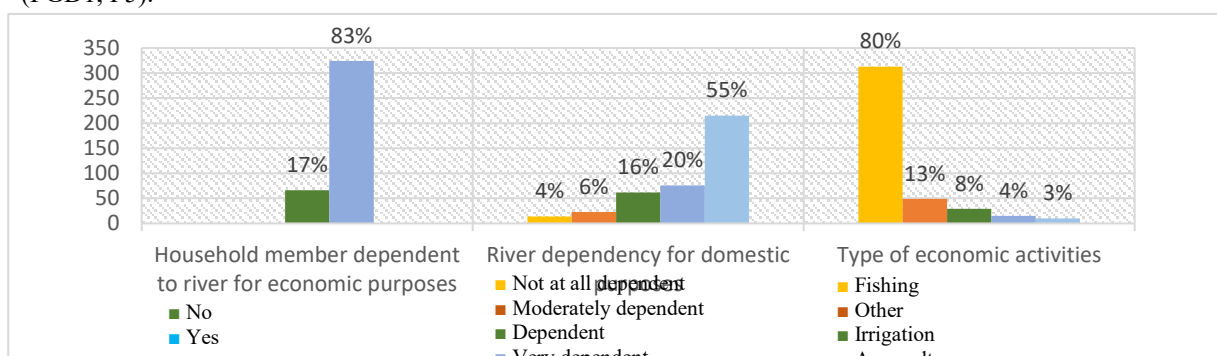


Figure 3: Households' dependency on river-water resources

Similarly, the majority (55%) reported being extremely dependent on the river for domestic needs (e.g., cleaning and bathing). During droughts, the Rio Grande River serves as the primary water source for both riverine households and nearby villages, supporting both domestic needs and agricultural activities. This heavy reliance on the river increases household vulnerability. The findings show that while some residents use the river as a supplemental source, others depend on it exclusively. Any deterioration in water quality directly affects these communities (Deb et al., 2021), underscoring the need for sustainable conservation and sustainable river management to protect the livelihoods of those living along the rivers.

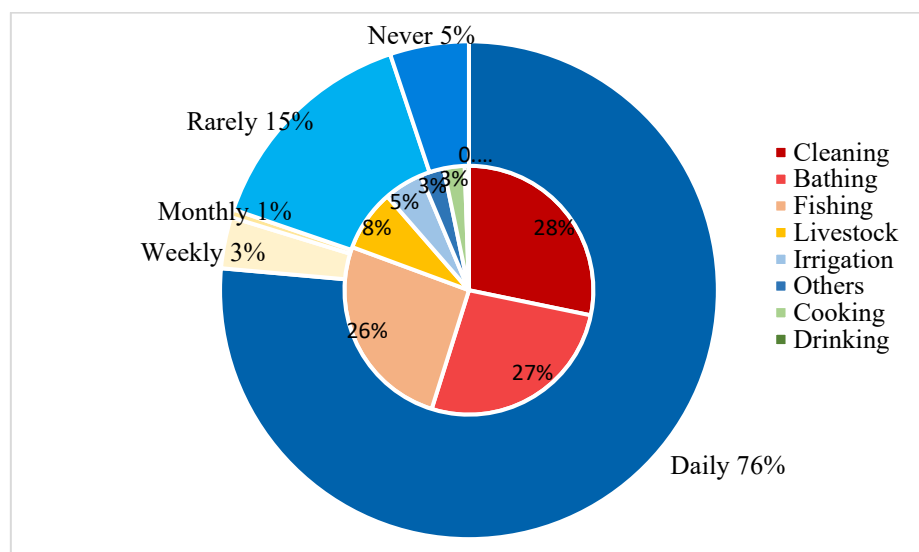


Figure 4: Frequency and purpose of river-water use

Some of the fishermen also farm to diversify income, even though most do not own the land where they grow rice, vegetables, and corn. Access to farmland is therefore seen as vital. As one participant noted, “When there is no flood, we can earn for our survival through farming” (FGD1, P1). However, this dependence on natural resources increases ecological pressure and pollution, threatening long-term sustainability. If river ecosystems deteriorate, these communities become more vulnerable (Malhi et al., 2020). These findings suggest that policies and poverty reduction programs must prioritize the development of alternative livelihood skills and support for activities beyond fishing and farming.

Livelihood vulnerabilities of the riverside households

Armed conflict and family feuds. Over 60% of Mindanao’s cities and municipalities have been affected by decades of armed conflict (World Bank, 2018, cited in Samama & Bidad, 2024). The Maguindanao provinces, located in the southern part of Mindanao Island, are characterized by political clans and family feuds, and are home to members and leaders of rebel groups, including the Moro rebels. FGD participants identified two major causes of armed conflict and family feuds in these areas: land disputes and struggles for political power. Land disputes often arise when new infrastructure, such as roads, is constructed. While these projects are expected to bring progress and support community livelihoods, they can also entail hidden costs.

Family feuds not only threaten the livelihoods of the riverside communities but also hinder their overall progress. These conflicts have created fear, especially among children and women, resulting in school dropouts among children and the displacement of families. FGD participants claimed that family feuds have been gradually resolved with help from local leaders, elders, and leaders of Moro Rebel groups, who hold significant influence over community decision-making. The use of social capital, including informal networks and traditional leaders, plays a crucial role in addressing and resolving these challenges.

Prevalence of illegal fishing practices. The high dependency of the riverside communities puts pressure on the ecological balance of the river water system. This pressure threatens the gradual depletion of the river’s ecological resources, including fish stocks. During the fieldwork, we observed residents innovating fishing equipment that surpasses acceptable standards. FGD participants describe fishing as a seasonal and unreliable source of income. Several admitted that they are gradually shifting to other livelihoods. Others admitted to innovating fishing gear and devices, such as electrofishing, fine-mesh nets, and other locally invented fishing gear, to adapt to these challenges.

The villagers are aware of the ordinances banning illegal fishing gear and practices. However, as one village leader revealed during the interview, illegal fishing remains difficult to address because those involved are armed with guns and fight back when confronted. These activities result in the depletion of fish resources and income loss (Merem et al., 2019), potentially pushing riverside communities into deeper poverty if left unchecked. Addressing this, a local leader in Cotabato City noted that implementing the law is challenging without alternative livelihoods for fisherfolk. Supporting this view, Wickremasinghe et al. (2018) found that providing livelihood training programs in conjunction with co-management strategies for the river can help reduce illegal fishing.

Recurring and prolonged flooding and soil erosion. The riverside communities consider flooding as the most serious threat. Communities near rivers are more susceptible to flooding and soil erosion. Most participants

reported being flooded 3-4 times a year. They view flooding as a barrier to progress because it affects their livelihoods, including farms and crops, and disrupts their daily lives. During the FGD, participants described specific adaptation strategies, such as constructing makeshift tents along concrete village roads, relocating belongings to higher ground, pooling resources for communal protection, and utilizing concrete linings along the riverbanks as temporary evacuation centers. These strategies highlight the importance of both physical and social capital. One participant shared: “Whenever we are flooded, we move out from our houses and temporarily stay in the makeshift tents along the nearest concrete road in our village so we can still go back to our house at night.” (FGD3, P5). Village roads and concrete linings along the riverbanks serve as temporary evacuation centers during heavy flooding. This occurs in the absence of emergency facilities. These vulnerabilities are exacerbated by low economic status and limited income, which constrain the livelihood assets needed to cope with or adapt to climate variability (Pandey et al., 2017).

Several participants shared that when their houses are severely flooded and become impassable, they temporarily move to relatives in safer places, returning after the flood subsides. Some participants view flooding and other natural disasters as usual and as God's will, leading them to accept these events as fate and leave the outcome in God's hands. The challenging situation of riverside communities traps them in a cycle of poverty, posing a threat to their sustainable livelihoods.

Conclusions

This study demonstrates the limited and weak livelihood capitals of the riverside households along the Rio Grande de Mindanao in the Philippines, heightening their vulnerability to both socio-economic and environmental shocks. Households are generally characterized by weak financial capital, as indicated by their low and unstable incomes, which serve as a critical constraint on engaging in livelihood diversification strategies. Similarly, the size and quality of the household's workforce suggest constrained human capital. These reinforce their dependence on a raw-materials-based economy, resulting in lower productivity and restricted opportunities. Furthermore, the near-absence of formal networks that could have helped them access essential services and opportunities indicates weak social and institutional capital among riverside households. Moreover, the presence of a strong informal network serves as a safety net, especially in times of disaster, to help them cope with shocks through resource sharing and mutual support.

The lack of infrastructure (physical capital) essential to sustain the livelihoods of the riverside households reinforces their physical vulnerability and livelihood insecurity. The geographic location of households limits their access to essential social services, such as health care, sanitation facilities, and safe drinking water, which are fundamental to household members sustaining and protecting their livelihoods. Similarly, the high dependence of households on their natural ecological systems contributes to their vulnerability to significant economic and environmental threats and heightens their vulnerability to persistent poverty.

The limited livelihood capitals of the riverside communities are further exacerbated by multiple vulnerabilities, including environmental threats such as recurring and prolonged flooding, social unrest characterized by rido and armed conflict, and the unsustainable exploitation of riverine ecological systems and resources.

The results underscore the importance of bottom-up, context-specific policies and programs that address both immediate social, economic, and environmental threats and the underlying structural causes. Such a policy is essential for implementing sustainable interventions that acknowledge the interdependence between river water resources and local communities. These measures are expected to enhance adaptive capacity, support sustainable livelihoods, and disrupt the cycle of poverty and environmental degradation.

Development agencies engaged in poverty alleviation should prioritize the formulation of context-specific interventions. These should directly strengthen households' livelihood capital assets by conserving and protecting natural resources, ensuring sustainable ecological goods and services. Human capital should be improved by building capacity through the provision of alternative livelihood opportunities and by supporting community-level adaptation strategies. Financial capital could be improved through facilitating access to financial support services. Social capital can be strengthened by enhancing linkages to formal institutions and agencies, and by organizing and empowering people-led community-based organizations. Finally, improving physical capital at both household and community levels requires better access to water, sanitation, and hygiene facilities, which are basic for every household, and infrastructure that increases access to markets, healthcare, and emergency services.

Acknowledgement

The authors express their gratitude to the Department of Budget and Management for the financial assistance provided through the Mindanao Sulu Palawan (MinSuPala) Innovative Research and Development Consortium.

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